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Remarks/Arguments

Subsequent to the Office Action issued on 28 April 2005, claims 1-28 are pending in the Application. By this response to the Office Action, claims 10 and 18 have been amended. Claims 1 – 28 remain in consideration.

The Office Action dated 28 April 2005 rejected claims 1-5, 10-18 and 22-24 under 35 U.S.C. §102(b) as being anticipated by *Teraji, et al.*, United States Patent Application Publication No. 2001/0022168. The Office Action further rejected all remaining claims 6-9, 19-21 and 25-28 under 35 U.S.C. §103(a) as being unpatentable over *Teraji, et al.*, in view of *Kakaho, et al.*, United States Patent Application Publication No. 2002/0046741.

Claim Rejections – 35 U.S.C. § 102

The examiner stated that claims 1-5, 10-18 and 22-24 were rejected under 35 U.S.C. §102(b) as being anticipated by *Teraji, et al.*, in that the reference teaches a controlled auto-ignition engine wherein a first injection occurs during an intake stroke and second injection occurs during the latter half of the compression stroke. It was also stated, with reference to Fig. 13 of the application publication, that at lower engine loads, the percentage of first injection fuel quantity is less than 50 percent and falls within the applicant's stated range. Paragraphs 122, 138 and 139 were also referenced. Applicant respectfully traverses the rejection of claims 1-5, 10-18 and 22-24 under 35 U.S.C. §102(b) as being anticipated by *Teraji, et al.*.

Claims 10 and 18 have been amended to more particularly point out and distinctly claim the patentable subject matter of the invention. No new matter has been added by these

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amendments. Newly amended claim 10 sets forth a method of operating a direct-injection, four-stroke, internal combustion engine comprising, *inter alia*, the added restriction of operating the four-stroke internal combustion engine in a substantially unthrottled condition. Newly amended claim 18 sets forth a method of operating a direct-injection, four-stroke, internal combustion engine comprising, *inter alia*, the added restriction of operating the four-stroke internal combustion engine in a substantially unthrottled condition. Applicant respectfully argues that amended claims 10 are patentably distinguishable over *Teraji*, et al. because *Teraji*, et al. neither teaches nor describes engine operation in a substantially unthrottled condition. Reconsideration of newly amended claims 10 and 18 is respectfully requested.

In reference now to Claims 1, 11, and 22, in order for a prior art reference to anticipate, the prior art must be enabling, thus placing the allegedly disclosed matter in the possession of the public. *Akzo N.V. v. US Int'l Trade Comm'n*, 1 USPQ2d 1241, 1245 (Fed Cir. 1986), 808 F.2d. 1471. Furthermore, “[a]bsence from the reference of any claimed element negates anticipation.” *Row v. Dror*, 42 USPQ 2d 1550, 1553 (Fed. Cir. 1997) (quoting *Kloster Speedsteel AB v. Crucible, Inc.*, 230 USPQ 81, 84 (Fed. Cir. 1986)).

Applicant respectfully asserts that *Teraji*, et al. lacks enablement with regard to applicant's claim of the percentage of first injection fuel quantity being less than 50 percent. Specifically, referenced Figure 13 of *Teraji*, et al. contains no scaling on either axis, thus leaving the percentage of first injection fuel quantity open to interpretation by one skilled in the art. Referenced paragraphs 122, 138, and 139 of *Teraji*, et al. provide no enablement, i.e.

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no quantitative information, about the percentage of first injection fuel quantity. However, paragraph 0124 of *Teraji*, et al., which references Fig. 13, provides enablement with regard to the percentage of first injection fuel quantity. In paragraph 0124, it specifically states “[p]referably, in each of the embodiments, the fuel quantity for the second fuel injection is less than 40 percent of the total fuel injection quantity . . .”. The disclosure of *Teraji*, et al. repeats the second fuel injection being less than 40 percent of the total fuel injection in paragraphs 0131 and 0152. The disclosure of *Teraji*, et al. teaches and discloses only that the first fuel injection must necessarily be greater than 60 percent of the total fuel injection quantity.

In contradistinction to *Teraji*, et al., the instant invention set forth in Claims 1, 11, and 22 include providing to the combustion chamber during an intake event a first fraction of fuel of about 10 to about 50 percent of a total controlled auto-ignition combustion cycle fuel requirement. Therefore, *Teraji*, et al. can not anticipate Claims 1, 11, and 22 of the instant invention because *Teraji*, et al. provides no enablement of the stated ranges for the percentage of fuel delivered during the first injection event of the instant invention. The stated ranges for the percentage of fuel delivered during the first injection event of the instant invention neither touch, overlap, nor fall within the stated ranges taught by *Teraji*, et al.

In reference now to claims 2, 4, 12, 13, 23, and 24, to anticipate, the identical invention must be shown in as complete detail as is contained in the claim. *Richardson v. Suzuki Motor Co.*, 868 F.2d 1226, 1236, 9 USPQ2d 1913, 1920 (Fed. Cir. 1989). Applicant

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respectfully argues that *Teraji*, et al. lacks enablement with regard to applicant's claim of the first fraction of fuel injected about 0 to about 90 degrees after exhaust stroke top dead center. Specifically, as stated by the examiner, *Teraji*, et al. mentions a first fuel injection timing which falls in a range from the intake stroke, with no further description or enablement. However, applicant respectfully asserts that *Teraji*, et al. primarily teaches injecting a first injection quantity during the compression stroke of the engine cycle, as distinctly shown in Figs. 14 and 25, and described in paragraph 0126. The embodiments described with reference to Figs. 14 and 25, and Paragraphs 0126 and 0131, indicate a first fuel injection occurring "in the first or initial half of compression stroke".

In contradistinction to *Teraji*, et al., the instant invention of claims 2, 4, 12, 13, 23, and 24 each set forth a method of operating a direct-injection, four-stroke, internal combustion engine (as claimed in claims 1, 10, and 18) wherein said first fraction of fuel is injected about 0 to about 90 degrees after exhaust stroke top dead center, i.e. the first portion of the intake stroke in a four-cycle internal combustion engine. Therefore, applicant respectfully asserts that *Teraji*, et al. fails to anticipate claims 2, 4, 12, 13, 23, and 24 because it fails to show the identical invention in as complete detail as is contained in the claims. Specifically, *Teraji*, et al. cannot anticipate claims 2, 4, 12, 13, 23, and 24 of the instant invention because *Teraji*, et al. neither teaches nor describes injecting the first fraction of fuel 0 to about 90 degrees after exhaust stroke top dead center, i.e. during the first half or initial portion of the intake stroke.

The remaining claims 3, 5, 14-17 all depend – some with intervening claims - from

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one of claims 1, 2, 4, 11, 12, and 13, and claim additional respective limitations thereto. Therefore, claims 3, 5, 14-17 are allowable over the prior art cited thereagainst for the same reasons set forth with regard to allowable claims 1, 2, 4, 11, 12, and 13.

Claim Rejections – 35 U.S.C. § 103(a)

Claims 6-9, 19-21 and 25-28 were rejected under 35 U.S.C. § 103(a) as being unpatentable over *Teraji, et al.*, in view of *Kakuho, et al.*, United States Patent Application Publication No. 2002/0046741. It was stated that *Teraji, et al.* applies, but does not disclose whether EGR is used in the engine, but that it would have been obvious to one of ordinary skill in the art to have included some form of EGR so as to regulate the temperature within the combustion chamber and thereby control the auto-ignition better. Remaining claims 6-9, 19-21 and 25-28 all depend, some with intervening claims - from one of claims 1, 2, 11, 12, or 22, and claim additional respective limitations thereto. Therefore, claims 6-9, 19-21 and 25-28 are allowable over the prior art cited thereagainst for the same reasons set forth with regard to allowable claims 1, 2, 11, 12, and 22.

Additionally, it was stated by the examiner that vacuum inherently occurs during the intake stroke in the combustion chamber, and it was believed that the claimed vacuum falls within a range common to engines. The fact that a certain result or characteristic may occur or be present in the prior art is not sufficient to establish the inherency of that result or characteristic. *In re Rijckaert*, 9 F.3d 1531, 1534, 28 USPQ2d 1955, 1957 (Fed. Cir. 1993). Furthermore, “[i]n relying upon the theory of inherency, the examiner must provide a basis in

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fact and/or technical reasoning to reasonably support the determination that the allegedly inherent characteristic necessarily flows from the teachings of the applied prior art." *Ex parte Levy*, 17 USPQ2d 1461, 1464 (Bd. Pat. App. & Inter. 1990) (emphasis in original).

Applicants respectfully traverse any rejection of claims based upon inherency related to occurrence or magnitude of vacuum created within a combustion chamber during the intake stroke. The examiner provided limited basis in fact or technical reasoning to support the assertion that vacuum inherently occurs during the intake stroke in the combustion chamber, and the belief that the claimed vacuum falls within a range common to engines.

When the statement "common to engines" is made, it raises a question about what is common to engines. There are many engine configurations, even in context of a reciprocating piston engine. Applicants respectfully assert that pressure level within a combustion chamber is determined based upon a number of factors including primarily, presence and position of a throttle body and throttle valve, design of intake manifold runners to intake valves, opening and closing of intake and exhaust valves, and speed and direction of the piston in the chamber. Applicants argue that the engine system described in the claimed invention of the instant application is distinguishable from the "common to engines" that informs the examiner's inherency statement.

In support of the traverse, applicants direct attention to Fig. 3 of the invention, wherein a graph is shown comprising a measurement of average cylinder pressure as a function of crank angle, measured during execution of the claimed method of operating the direct-injection, four-stroke, internal combustion engine. The data presented in Fig. 3 clearly

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demonstrates that in the engine configuration tested, magnitude of in-cylinder pressure increased from a low pressure (i.e., vacuum) level, created by closing of both the intake and exhaust valves during the intake stroke, subsequent to opening of the intake valve during the intake stroke. The data demonstrates that in-cylinder pressure reaches atmospheric pressure conditions during the intake stroke, even though the volume of the combustion chamber increases during this time due to movement of the cylinder. Thus, evidence in applicants' disclosure clearly rebuts any assertion of occurrence or magnitude of vacuum created within a combustion chamber during an intake stroke that is based upon inherency. Therefore, applicants respectfully request that any claim rejections based upon the argument of inherent vacuum in the combustion chamber be withdrawn. Applicants believe this affects at least claims 5, 19, and 21.

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Conclusion

Based upon all of the above, it is respectfully submitted that pending claims 1 – 28 are in condition for allowance and that same be allowed to proceed to issue. If the Examiner has any questions regarding the contents of the present response, Applicant's attorney may be contacted at the phone number appearing below during normal business hours (EST).

Respectfully submitted,



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